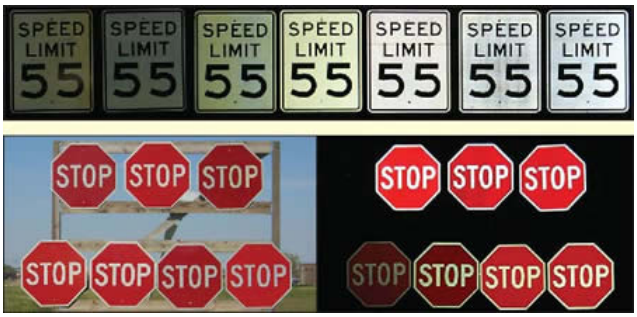
New Hampshire DOT
Department of Transportation

Focus on Research

Inside this Issue:

Innovative Technologies Become Standard	2
Surface Resistivity Test	2
Qualified Products List	3
Search for Longer-Lasting Pavements	3
Monitoring Modified Guardrail	4

A Strategy for Efficiently Managing Sign Retroreflectivity



The FHWA Manual on Uniform Traffic Control Devices (MUTCD) establishes minimum retroreflectivity standards for signs on public roads and requires public agencies to implement an assessment or management program designed to maintain retroreflectivity at or above the regulatory levels.

The MUTCD identifies five (5) acceptable methods for determining if signs meet the minimum requirements. In the Assessment category, methods include Visual Nighttime Inspection and Measured Sign Retroreflectivity. In the Management category, methods include Expected Sign Life, Blanket Replacement, and Control Signs.

Research was conducted to determine the most suitable method for implementation by NHDOT. Advantages and disadvantages for each of the five methods were identified. Visual Nighttime Inspection was selected as the most economical method due to the speed at which a review can be accomplished and the minimal resources needed to conduct the inspection. Other factors leading to this selection included the ability to implement quickly and the absence of a sign inventory. Development of a statewide sign inventory will enable the NHDOT to collect data on how long certain sign types last and may lead to Expected Sign Life as the preferred method in the future.

Wood Preservative Synthesis and Best Management Practices

Historically the NHDOT has used treated wood timber products in the construction and repair of railroad trestles. In recent years, negative impacts were observed within environmentally sensitive areas; for example, repairs to the Frankenstein Trestle in Crawford Notch in 2008 included the installation of timbers that continued to release creosote more than a year after initial construction. As a result, the Department temporarily suspended the use of treated wood timbers pending results from a recently-completed synthesis study.

Tarp Installed below the Frankenstein Trestle in Crawford Notch to Protect Hiking Trail from Dripping Creosote

The synthesis provides 1) an assessment of the various wood preservatives and available treatment/curing techniques in current use, 2) the advantages/ disadvantages of each product/technique, 3) guidelines on the recommended use/non-use of various alternatives, and 4) best practices and engineering controls to limit future environmental impacts. The study also included identification of alternative non-wood products currently in use for similar applications.

It was recognized at the beginning of the study that a wealth of information currently exists on the subject. As such, the scope was intended to capture existing industry

(Continued on page 4)

Implementation Corner

Innovative Technologies Become Standard Practice In New Hampshire

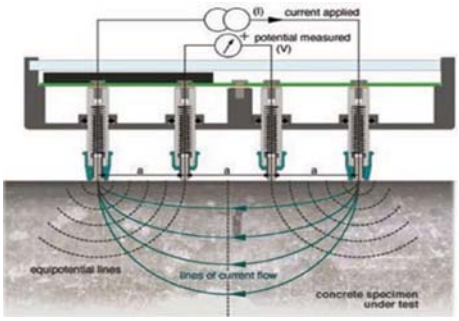
- **Recycled Asphalt Pavement (RAP)** - NHDOT hot mixes currently average 22% RAP content statewide. In 2011, a 20-year old, 35% RAP pavement on I-93 was re-recycled to produce a 40% RAP mix. Research is ongoing to enable up to 50% RAP content or higher.
- **Warm Mix Asphalt (WMA)** - Over 41% of NHDOT asphalt mixes produced in 2011 utilized warm mix technologies (predominantly foamers), reducing emissions and energy costs.
- **Self Consolidating Concrete (SCC)** - Self-consolidating concrete is now produced routinely for precast applications in New Hampshire.

Completed Research

Surface Resistivity Test Evaluation Completed

A concrete's ability to resist the penetration of moisture and chlorides is a critical factor in reducing the potential for corrosion and damage from freeze/thaw. The NHDOT has utilized the Rapid Chloride Permeability Test (RCPT) to measure this parameter since the early 1990s and test results are incorporated into the Department's QC/QA specification for concrete.

The RCPT is a multi-stage test requiring substantial sample preparation and two days of testing. Equipment acquisition ($18,000) and maintenance costs can be significant. Alternatively, the portable Surface Resistivity Test (SRT) utilizes a low-cost ($3,000) Wenner probe and can obtain test results in minutes.

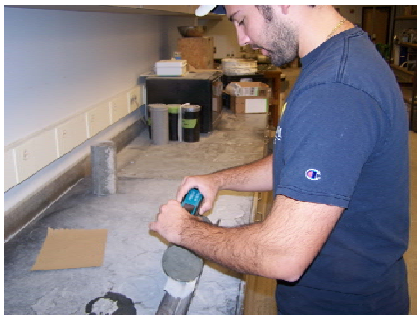


How it Works: SRT

- A current is applied between the two outer probes
- The two inner probes measure the potential difference
- Resistivity = **$2\pi aV/I$ [kΩ-cm]**
  - a = distance between probes
  - V = voltage (potential)
  - I = applied current

Successful use of the SRT in Florida and Louisiana prompted the Department to purchase and evaluate the device as a potential replacement for the RCPT. SRT tests were compared to RCPT tests at 28, 56, and 91 days. The research demonstrated good correlation ($R^2 = 0.91$) between the two methods at all tested ages across the entire spectrum of expected coulomb (RCPT) values. Precision (repeatability) was also excellent.

A simple spreadsheet approach allows the Department to determine pay factors based on the SRT. It is estimated that in-lab costs will be reduced by approximately $7,000 per year using the SRT, more than twice the cost of the device.



Qualified Products List (QPL) Update

The NHDOT Qualified Products List (QPL) is updated annually and includes over 100 categories of commonly-used construction products. Approximately 100 product submittals are received each year and the QPL database currently contains nearly 2000 products.

A number of recent developments are reflected in the 2012 QPL, available on the Department's website. Among the most significant:

- "L"-shaped Temporary Raised Pavement Markers are no longer allowed on multi-lane, high-volume roadways
- Expiration dates apply for certain QPL categories
- Addition of synthetic guardrail offset blocks
- Addition of anti-corrosion rebar coatings to protect against "ring anode" effect during deck repairs or when splicing black bar to epoxy-coated bar
- Concrete admixture qualification contingent upon approval of a mix design that includes that admixture

In addition, the Department is increasingly reliant on test results from the AASHTO National Transportation Product Evaluation Program (NTPEP), reducing the amount of testing or research done internally. Currently, the following product categories utilize NTPEP results as the primary means for qualification:

- Hot-Poured Crack Sealants
- Fast-Set Non-Shrink Patching Mortars
- Concrete Admixtures & Curing Compounds
- Reinforcing Steel
- Silicone Joint Sealants
- Geotextiles
- Erosion Control Matting
- Plastic Pipe (HDPE & PVC)
- Retroreflective Sign Sheeting
- Retroreflective Pavement Marking Tape

Product Evaluations

NHDOT Widens Search for Longer-Lasting Pavements

The New Hampshire Department of Transportation was featured twice recently in regional publications for its efforts related to pavement preservation technologies.

The November 2011 edition of New England Construction magazine contains an article on a 2.4-mile section of highly polymer-modified liquid asphalt binder (HiMA) placed on U.S. Route 202 in Rochester. The thin-lift overlay demonstration project was integral to an effort initiated by the Northeast Pavement Preservation Partnership (NEPPP), a regional DOT group dedicated to advancing pavement preservation practices through education, research and outreach.

The Summer 2012 edition of the Pavement Preservation Journal features an article on an asphalt rubber gap-graded (ARGG) overlay being used to preserve a 3-mile section of NH Route 38 in Pelham. The ARGG utilizes recycled tire rubber and provides a number of anticipated benefits including longer service life, increased resistance to reflective cracking, reduced tire water spray, and reduced tire noise.

Pavement preservation decisions by New Hampshire DOT are based on pavement condition data collected by a fully automated data-collection vehicle and generated by the computerized pavement management system (PMS), along with input from maintenance districts and cost/performance data of the various treatments used.

"Observation is a passive science; Experimentation is an active science."

- Claude Bernard

Wood Preservatives (cont'd from Page 1)

and agency practice and did not include testing, field analyses, development of new techniques, or new engineering controls or designs. The project deliverables included a matrix that incorporates the following information for various preservative materials:

- Cost
- Environmental considerations and limitations
- Longevity
- Safety considerations (worker health, fire susceptibility, special licenses/permits for field application)
- Disposal of waste wood products
- Availability

Following acceptance of the final report, the project Technical Advisory Group will prepare a series of recommendations and specifications for future use of wood preservatives in New Hampshire.

Monitoring of Modified Guardrail Sections Continues

When a roadway is resurfaced, the additional pavement thickness reduces the height of the guardrail relative to the roadway. When the guardrail no longer meets minimum height requirements, replacement or modification is required.

The FHWA has allowed the use of a modified detail provided that monitoring take place to document any resulting decrease in safety. The procedure consists of removing the existing block and rail, drilling a second hole in the post three inches above the existing hole, and drilling a second hole in the block three inches below the existing hole. The block is reattached to the post using two bolts, resulting in an increase of three inches in rail height.

Six projects with modified rail were selected for monitoring over a two-year period. Locations are documented using GPS and/or mile markers, and initial observations with photographs were made. Maintenance districts are responsible for notifying researchers when a known crash or guardrail damage occurs within a test section. Accident records are reviewed, subject to availability, and any anomalies or performance characteristics or deficiencies are noted.

The results of the monitoring will provide information to the NHDOT and FHWA regarding performance of the modified guardrail sections, and determine if future guardrails can be monitored in similar fashion.

Modified Guardrail System

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WHAT'S YOUR PROBLEM?